



AGENCY FOR HEALTHCARE RESEARCH AND QUALITY



# Improving Diagnosis and Treatment of Adult Depression Through Digital Healthcare

## **Presented by:**

Neda Laiteerapong, MD, MS  
Carolyn Turvey, PhD, MS  
Adrian Aguilera, PhD

## **Moderated by:**

Sheena Patel, MPH  
Agency for Healthcare Research and Quality

June 15, 2022

# Agenda



- Welcome and Introductions
- Presentations
- Q&A Session With Presenters
- Instructions for Obtaining CME Credits

Note: You will be notified by email once the slides and recording are available.

# Presenter and Moderator Disclosures



**Neda Laiteerapong, MD**  
Presenter



**Carolyn Turvey, PhD**  
Presenter



**Adrian Aguilera, PhD**  
Presenter



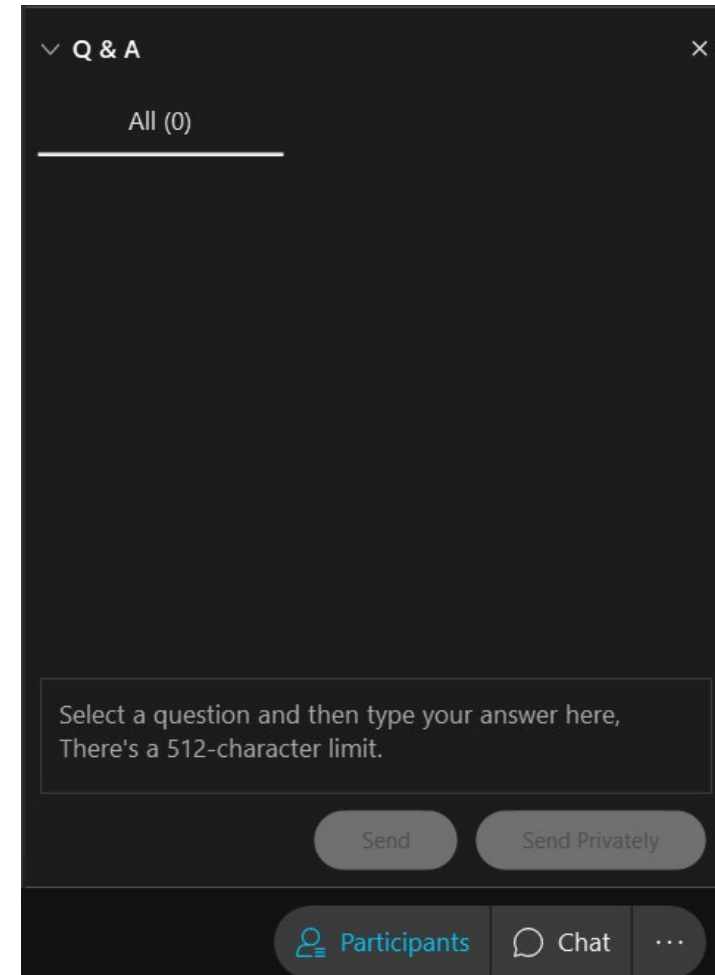
**Sheena Patel, MPH**  
Moderator

This continuing education activity is managed and accredited by AffinityCE, in cooperation with AHRQ and SD Solutions.

- Dr. Laiteerapong and Dr. Turvey have no relevant financial interests to disclose.
- Dr. Aguilera has the following relevant financial interests to disclose: Consultant for Syndi Health, Mobile Health Consumer, K Health; Advisory board member for BeMe Health.
- Sheena Patel has no relevant financial interests to disclose.
- AffinityCE, SD Solutions, and AHRQ staff, as well as planners and reviewers, have no relevant financial interests to disclose.
- Commercial support was not received for this activity.

# How to Submit a Question

- At any time during the presentation, type your question into the “Q&A” section of your WebEx Q&A panel.
- Please address your questions to “All Panelists” in the drop-down menu.
- Please include the presenter’s name or their presentation order number (first, second, or third) with your question.
- Select “Send” to submit your question to the moderator.
- Questions will be read aloud by the moderator.

A screenshot of the WebEx Q&A interface. At the top, it says "Q & A" with a dropdown arrow and a close button. Below that, it says "All (0)". The main area is a large text input field with a placeholder that says "Select a question and then type your answer here, There's a 512-character limit." At the bottom right of the input field are two buttons: "Send" and "Send Privately". At the very bottom of the interface are three buttons: "Participants" (with a person icon), "Chat" (with a speech bubble icon), and a three-dot menu icon.

# Learning Objectives

**At the conclusion of this webinar, participants should be able to:**

1. Describe how electronic patient-reported outcomes can improve depression diagnosis and treatment
2. Identify depression-specific digital health patient portal features that promote patient engagement, medical adherence, and reduction in depressive symptoms
3. Understand advantages and barriers to adaptive vs static messaging interventions for depression and self-management
4. Evaluate the overall impact of patient-engaged digital healthcare interventions on adult depression





AGENCY FOR HEALTHCARE RESEARCH AND QUALITY



# **Patient Outcomes Reporting for Timely Assessments of Life with Depression: *PORTAL-Depression***

**Neda Laiteerapong, MD, MS**

**Associate Professor, Departments of Medicine and Psychiatry & Behavioral Neuroscience**

**Associate Director, Center for Chronic Disease Research and Policy**

**University of Chicago**

# Funding / Disclosures

- Patient Outcomes Reporting for Timely Assessment of Life with Depression (PORTAL-Depression) funded by AHRQ U18 HS26151-01, PI: Laiteerapong
- Nothing to disclose

# Objectives

- Describe how patient-reported outcomes in a portal can improve depression diagnosis and treatment
- Describe implementation and evaluation of PORTAL-Depression
  - ▶ Screening Trial – people with no history of depression
  - ▶ Monitoring Trial – people with history of depression
- Discuss challenges and lessons learned

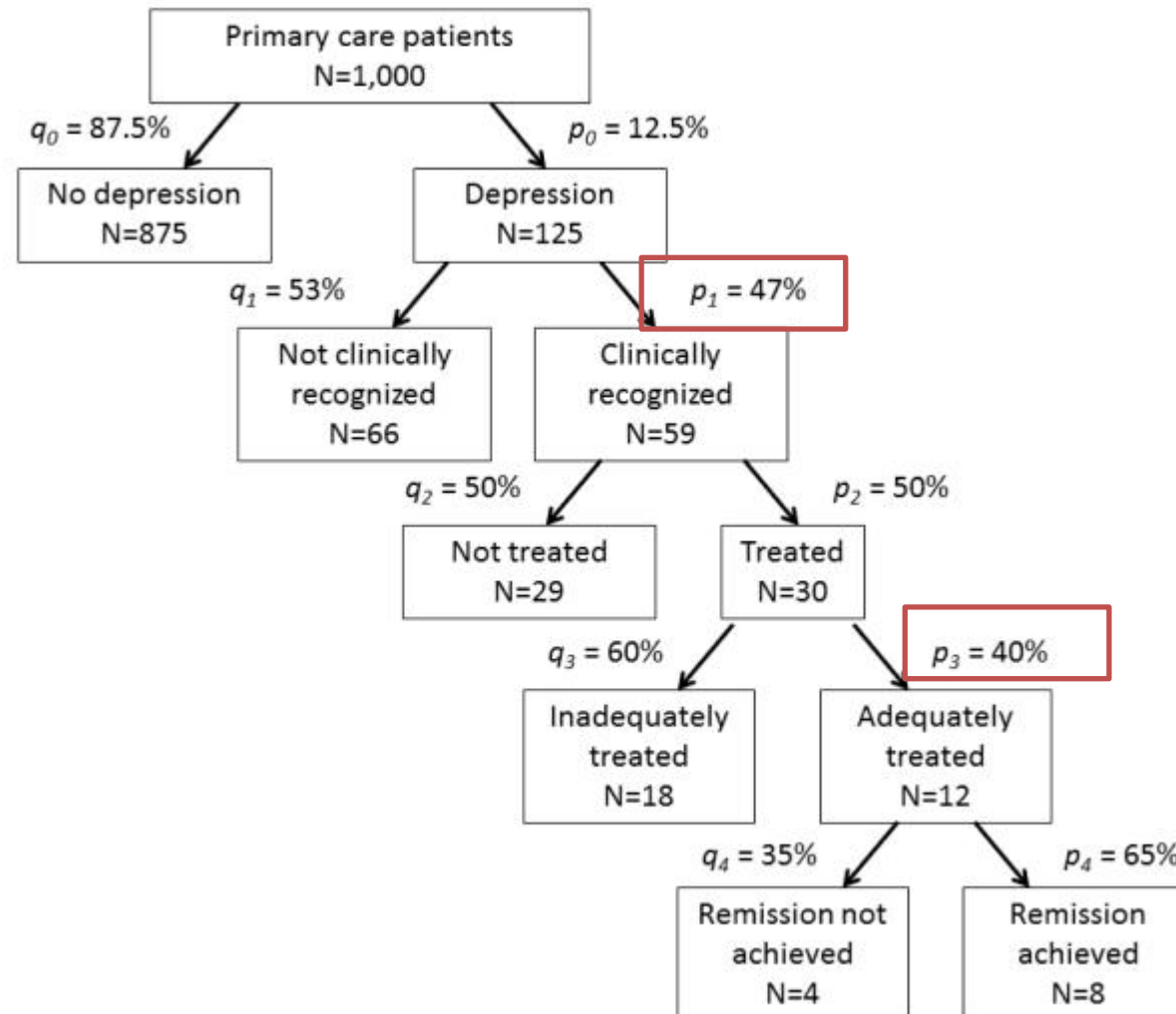


# Measurement-Based Care Can Help

Studies show regular assessment of depression symptoms using validated tools can optimize screening and treatment and increase remission



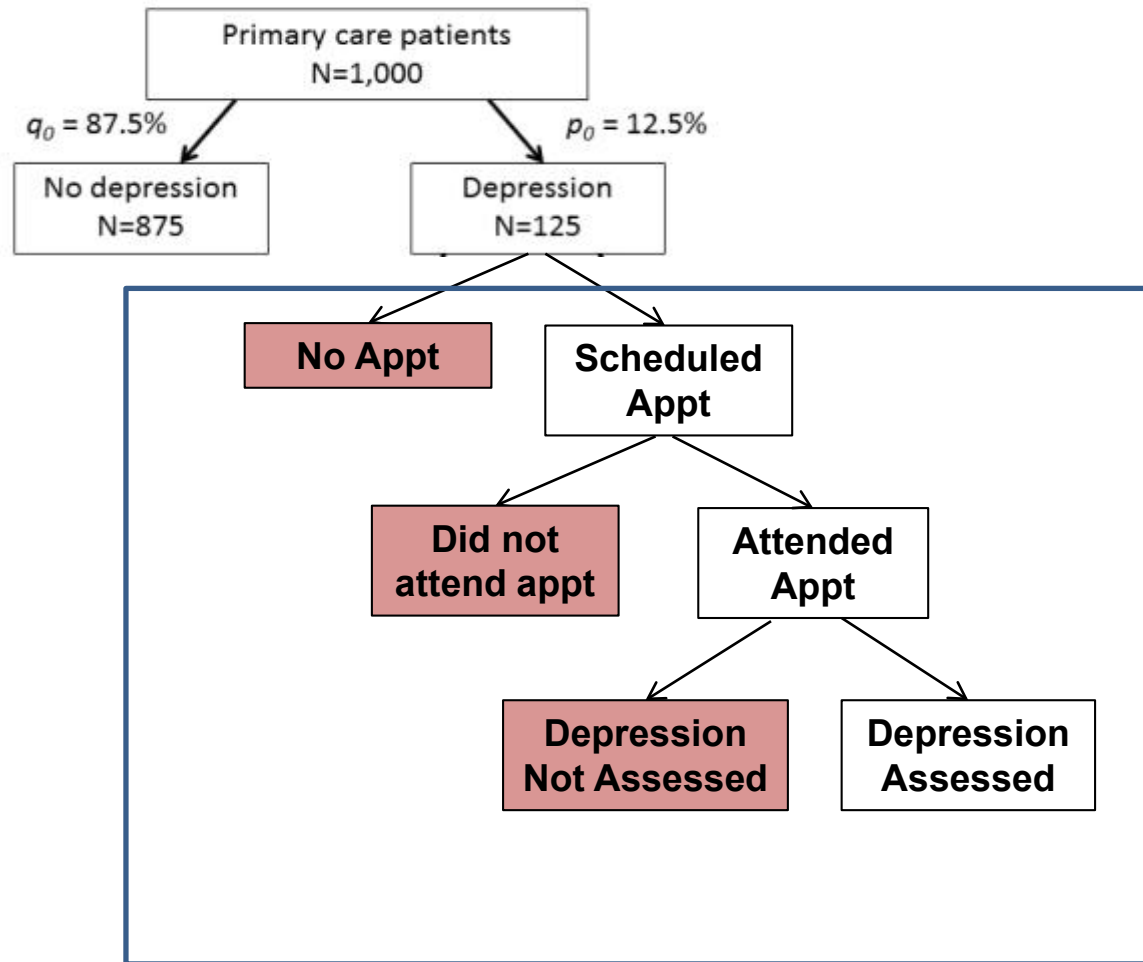
# The Depression Treatment Cascade in Primary Care: A Public Health Perspective



# Here are the current options...

1. Primary care provider (PCP) uses clinical judgement
2. PCP uses validated screener
3. Medical assistant (MA) uses validated screener → PCP reviews
4. MA gives patient (pt) screener to complete → PCP
5. Check-in gives pt screener → MA enters → PCP
6. Pre-visit questionnaire sent to pt → pt completes → PCP

# Current strategies address only patients who come to clinic appointments



Patients with depression more likely to not attend clinic appointments, more likely to no show/cancel, and use emergency and urgent care

# PORTAL-Depression Pragmatic Trials

To evaluate implementation and effectiveness of population health portal-based vs. visit-based usual care for depression screening and monitoring/surveillance.

# Patient Criteria

- Adult (age $\geq$ 18)
- Visit to primary care clinic in past 26 months (age 18-64) or 14 months (age $\geq$ 65)
- Active portal account
- Participating primary care provider
- Screening Trial: No depression screen in the past 12 months and no history of depression
- Monitoring Trial: Depression diagnosis or positive depression screen in past year



# Setting

- Urban hospital-based internal medicine / pediatrics clinic
- Health maintenance and best practice advisories in EHR show when patients are due for depression assessment
  - ▶ Screening = annual assessment for those without history of depression
  - ▶ Surveillance = annual assessment for those with history of depression
  - ▶ Monitoring = monthly assessment for those with current symptoms
- Protocol for medical assistants to do PHQ-2/9 or CAT-MH™ (adaptive mental health assessment) for screening and PHQ-9 for surveillance and monitoring during triage



# Pragmatic Trial Arms

## Usual care

- Alert in EHR when patient due for depression assessment
- At clinic visit, MA administers assessment if patient is due
- Alert and screener also available to PCPs during visits

## Population health

*Usual care plus...*

- Invitations via portal to complete CAT-MH™ online
- Sent when due regardless if appointment scheduled or not
- Results automatically saved in EHR and sent to PCP
- If completed, then health maintenance topics completed and in-clinic assessments not necessary

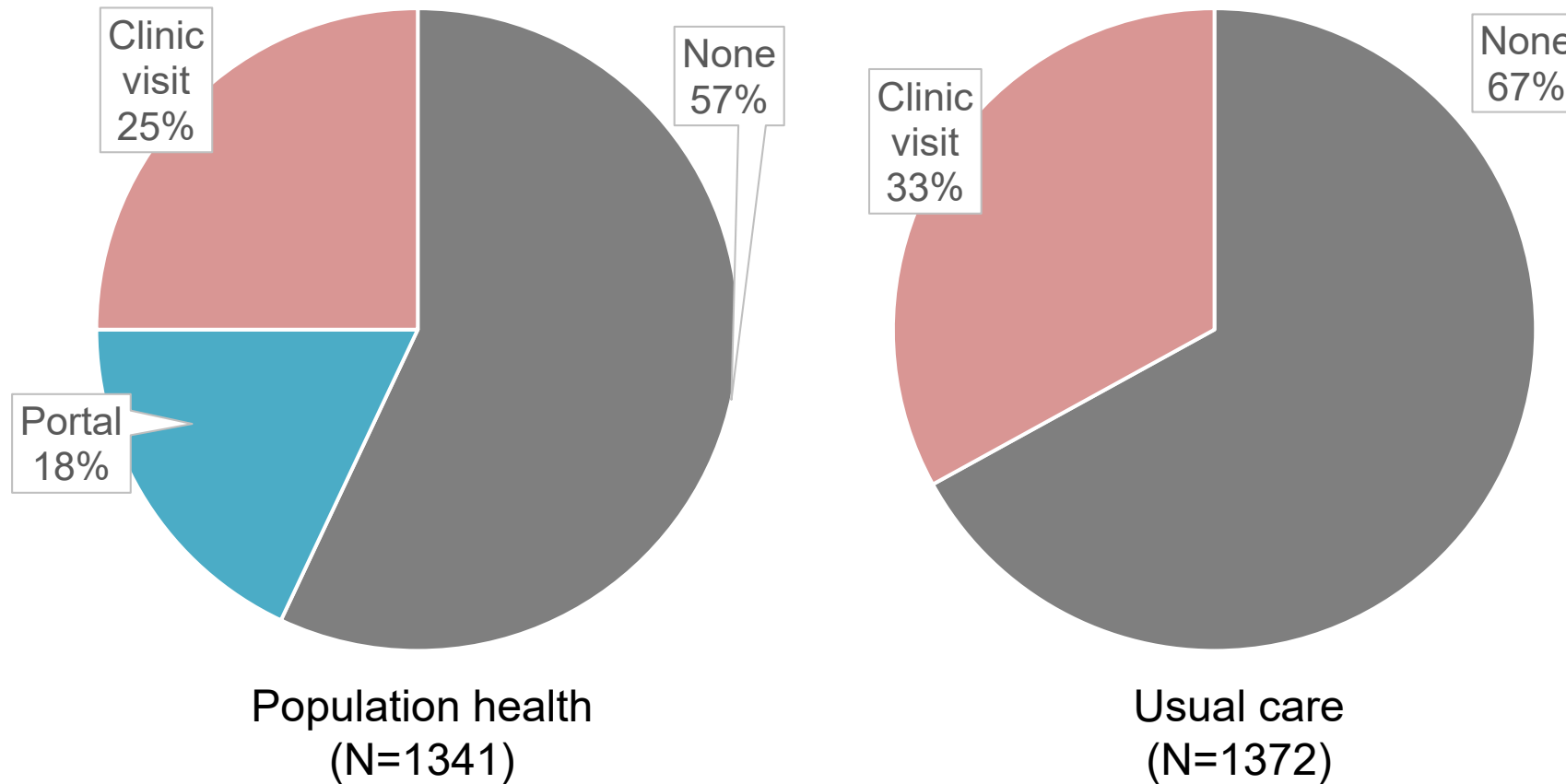
In both arms, PCPs alerted if moderate to severe result, and depression clinical decision support tool provided.

# Overall Demographics

	<b>Depression Screening Trial N=2713</b>	<b>Depression Monitoring Trial N=1448</b>
Age, mean (SD)	55 (17)	54 (17)
Sex, n (%)		
Female	1571 (58)	1053 (73)
Male	1142 (42)	395 (27)
Ethnicity, n (%)		
Hispanic/Latino	130 (5)	71 (5)
Race, n (%)		
Asian/Mideast Indian	207 (8)	54 (4)
Black/African American	1274 (47)	662 (46)
White	1098 (40)	651 (45)
Other/Unknown	139 (5)	71 (5)

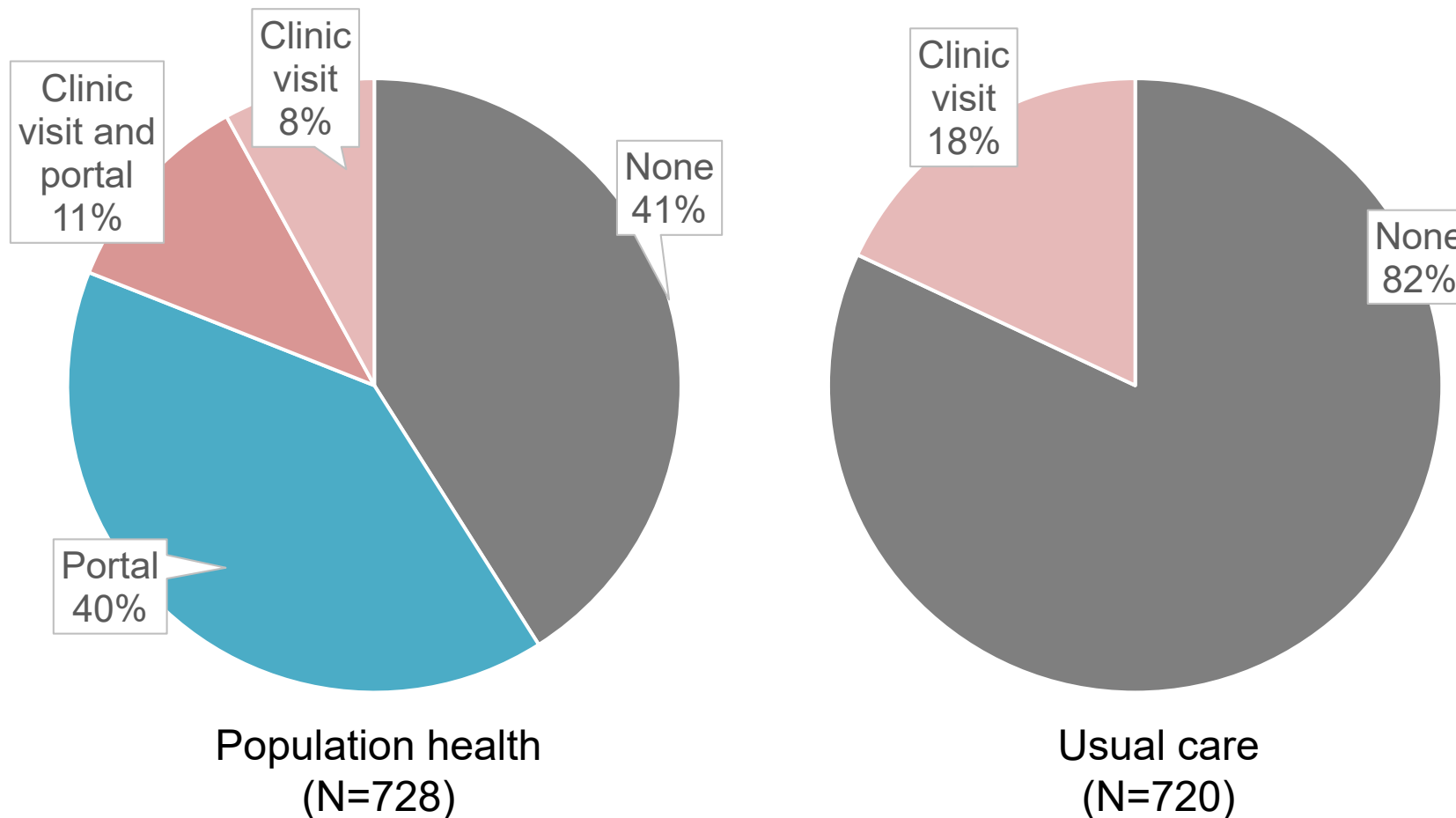
1:1 randomization, no differences in randomization by trial arm

# Screening Trial: Depression Screening Rate



$p < 0.001$

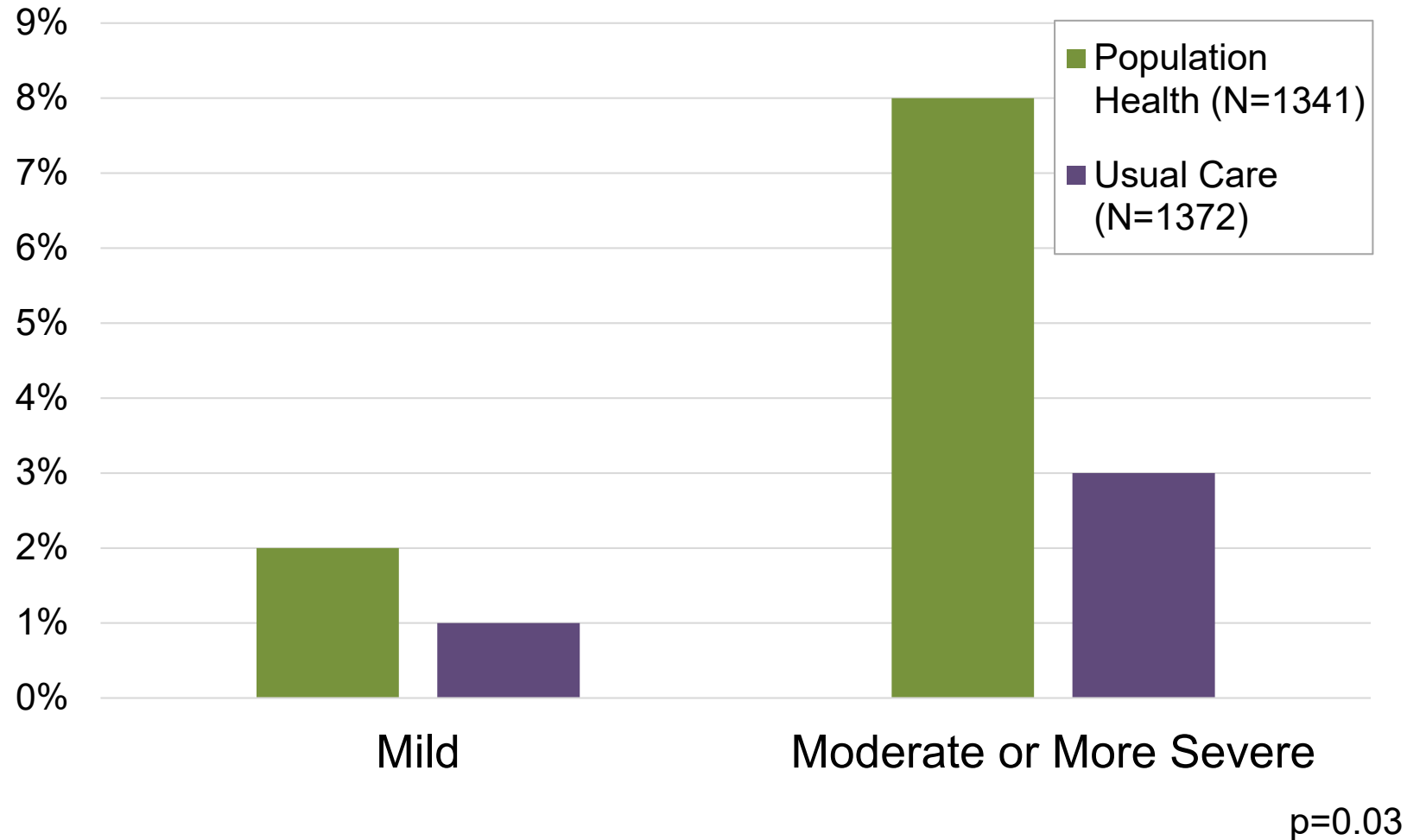
# Monitoring Trial: Depression Assessment Rate



59% (N=427) vs. 18% (N=126),  $p < 0.001$

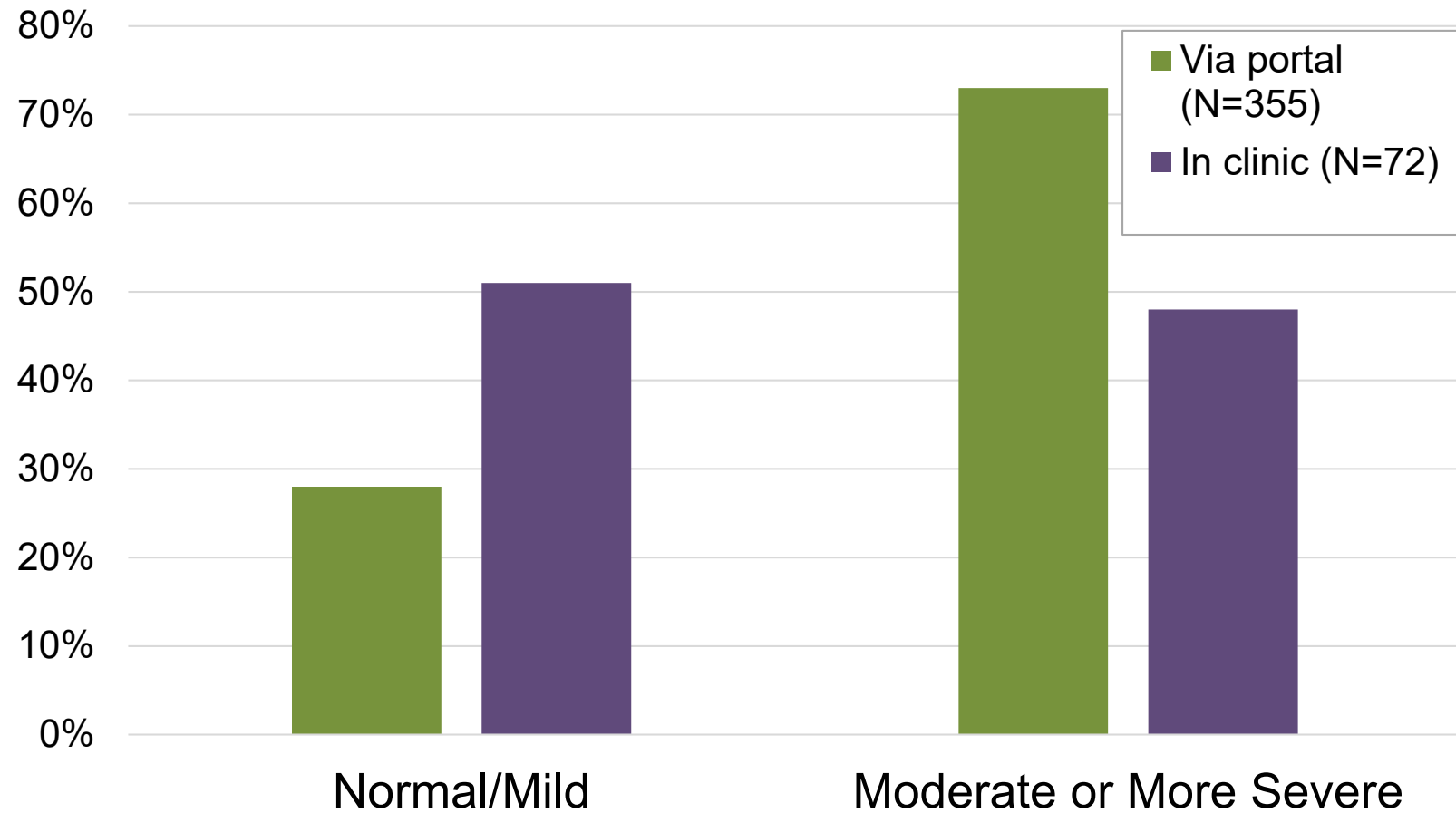
Limiting analyses to after the usual care protocol resumed in Jul 2020, assessment completion was still >3x higher in population health: 41% (N=300) vs. 12% (N=87),  $p < 0.001$ .

# Screening Trial – Higher Rates of Depression Severity in Population Health Arm





# Monitoring Trial – Higher Depression Severity in Patients who completed Assessments via Portal



p=0.03

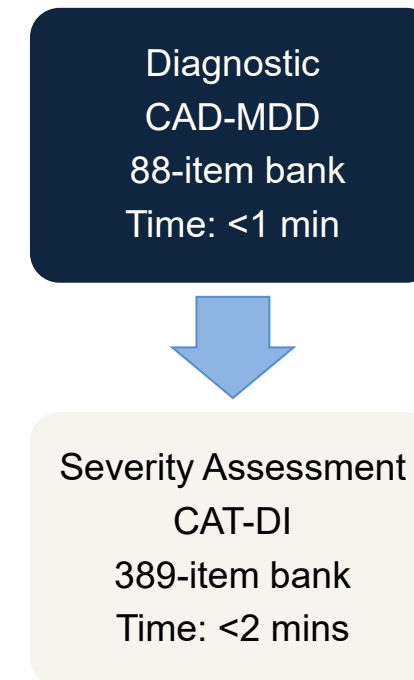
# LESSONS LEARNED

# Depression Assessment is Not 100% in Primary Care...Combination of Strategies is Best

1. Primary care provider (PCP) uses clinical judgement
2. PCP uses validated screener
3. Medical assistant (MA) uses validated screener → PCP reviews
4. MA gives patient (pt) screener to complete → PCP
5. Check-in gives pt screener → MA enters → PCP
6. Pre-visit questionnaire sent to pt → pt completes → PCP
7. Population health strategy?

# Population Health Arm

- Enlisted patient and provider feedback on portal invitation letter
- CAT-MH™ used because of better sensitivity than PHQ-2
  - ▶ AUC 0.85 vs. 0.76
  - ▶ Required a weblink → 30% click thru
- Some patients unaware symptoms were not normal
- Very few patient concerns



# Implications and Future Directions

- Portal can increase reach and frequency of depression screening, surveillance, and monitoring
- Population health approach using portal increased depression monitoring and surveillance
- Visit-based strategy misses those most in need of care
- Combine with integrated behavioral health models like collaborative care—care manager review portal results
- Additional population health strategies needed, considering response rate and disparities in portal engagement

# Acknowledgements



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Julie Johnson



Neda Laiteerapong



David M Liebovitz



John S Moses



# Acknowledgements

## Additional Stakeholders

- IT team
- Attending physicians
- Resident physicians
- Medical assistants
- Advanced practice nurses
- Registered nurses
- Clinic schedulers
- Clinic managers
- Patients



Sachin Shah



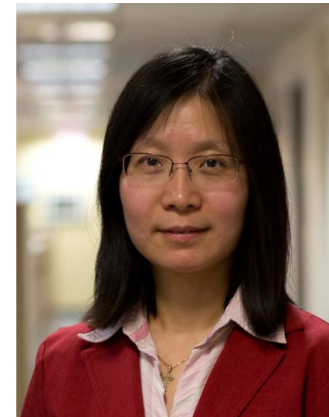
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AGENCY FOR HEALTHCARE RESEARCH AND QUALITY



# Patient Portals and Patient Engagement in Treatment for Depression

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**University of Iowa College of Medicine Department of Psychiatry**

**Iowa City VA Health Care System**

**Veterans Rural Health Resource Center- Iowa City**

# Disclosures

I have no industry ties and no financial relationships with any of the products discussed today.

# Support

- Development of a Targeted Patient Portal Intervention to Improve Depression Treatment Adherence, Satisfaction, and Outcomes
- R21 HSO25785-02 AHRQ
- Co-Investigators: Dawn Klein, MSW, Lindsey Fuhrmeister, Emily Chasco, Ph.D.

# Study Aims

#1 Identify desired portal features and functions through stakeholder interviews with a nationwide sample of mood disorder specialists and their patients.

#2 Integrate interview results to develop both portal features and a clinical protocol for ConnectCare.

#3 Test the usability, acceptability, and effectiveness of ConnectCare in a pilot randomized controlled trial of 30 patients. The primary hypothesis is that the patients receiving Connect Care will have improved scores on depression and functional outcomes as compared with those randomized to usual care.

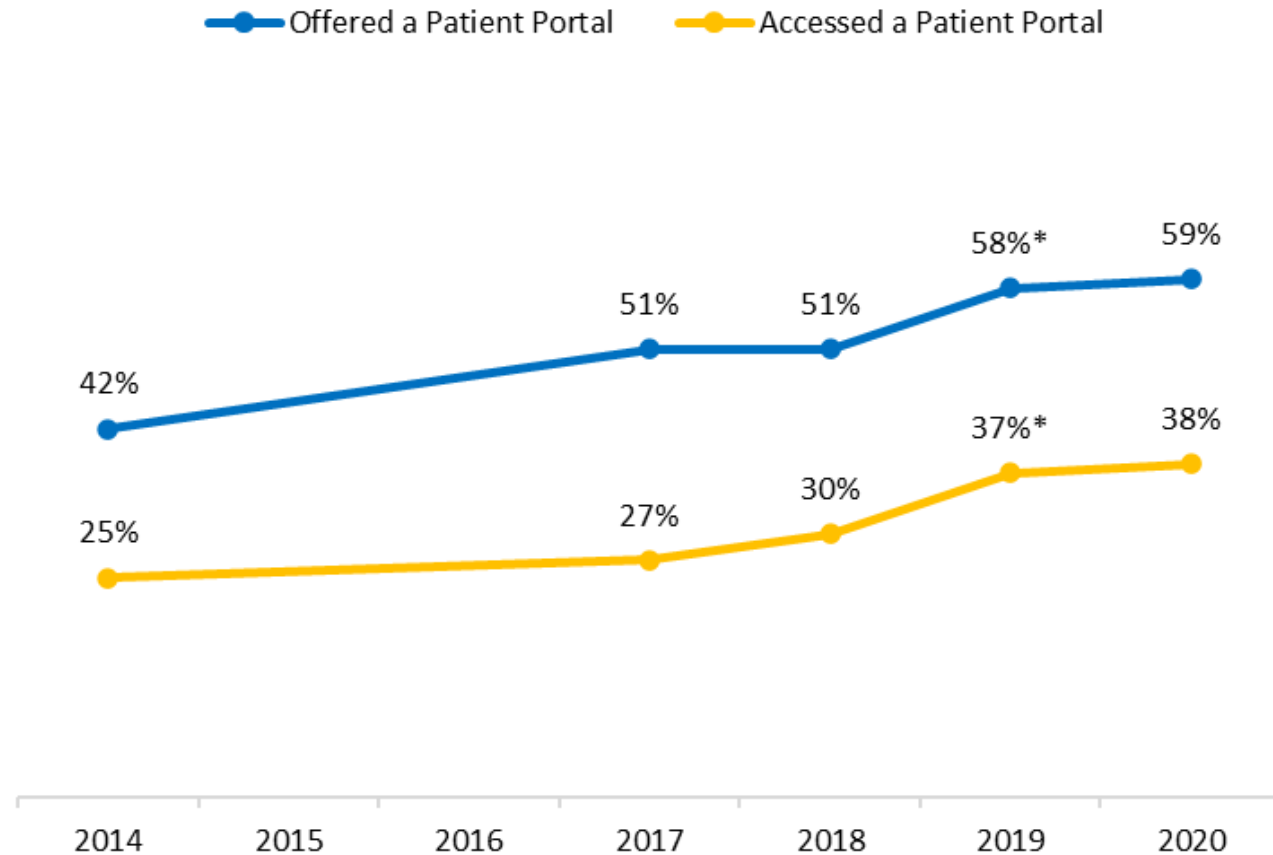


# Patient Portals

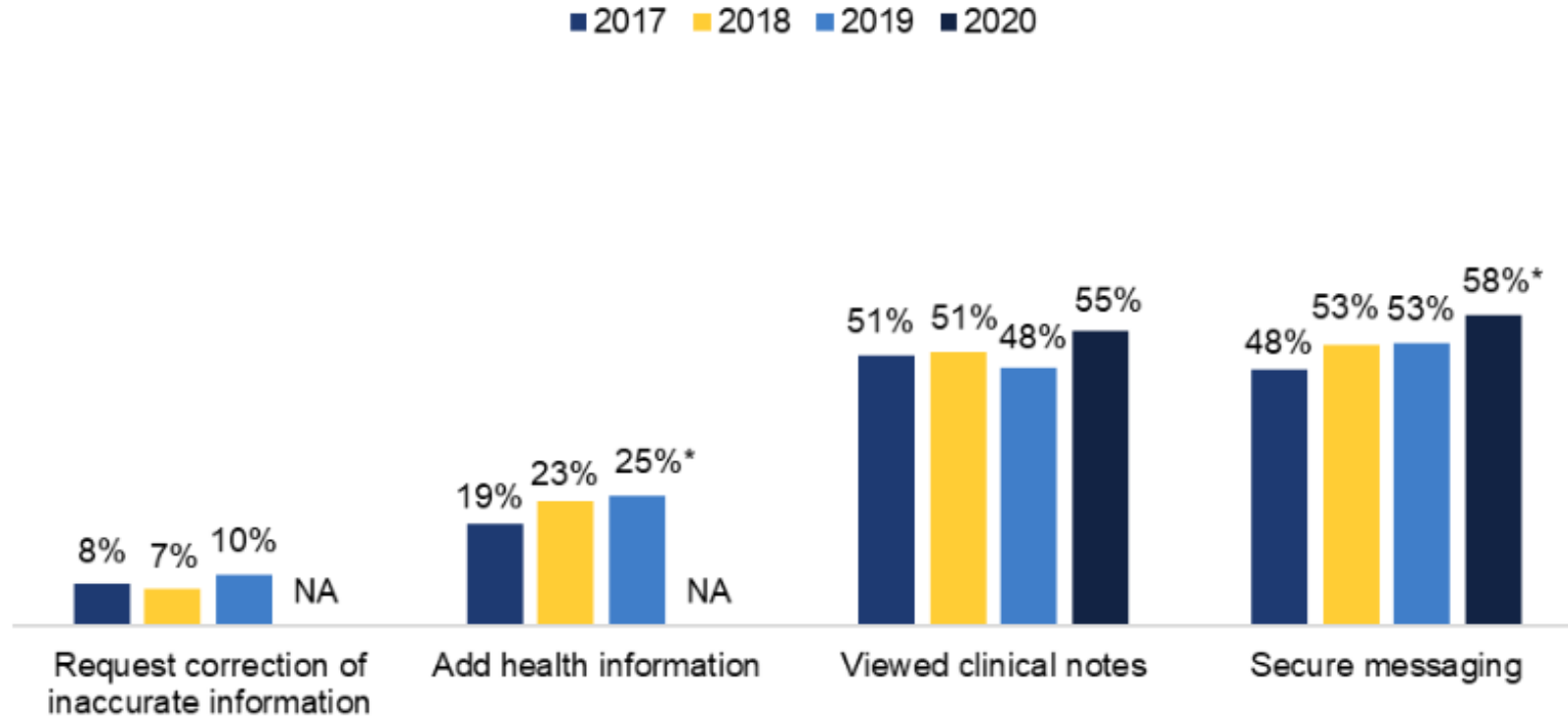


- Secure Online Website
- Tethered to their electronic health record
- Includes secure messaging
- Includes access to visit notes

# Office of the National Coordinator



# Office of the National Coordinator



**Figure 5: Percent of patient portal users who performed various functionalities in the past year, 2017-2020.**

Source: HINTS 5, Cycles 1-4 (2017-2020)

Notes: \*Significantly different from 2017 ( $p < 0.05$ ). Denominator represents individuals who accessed their portal at least once within the last year. Data for “Request correction of inaccurate information” and “Add health information” were not collected in 2020. Individuals who access their portal at least once in the past year are referred to as “patient portal users”.

# Patient Portals and Mental Health

- Mental health has unique privacy concerns.
- Like other chronic illnesses, patient activation is essential to good clinical outcomes.
- 21<sup>st</sup> Century Cures Act required patient portals to allow mental health patients to view their visit notes.

# Online Survey- Providers N=80

- 29 of 80 (36%) worked at organizations which allowed patients access to their mental health visit notes.
  - ▶ 72% reported patients requesting a change in the note
  - ▶ 69% reported patients asking more questions
  - ▶ 69% reported having a patient who experienced distress after reading the note

# Online Survey- Patients N=168

- 37 (22%) endorsed having access to mental health notes.
  - ▶ 86% reported having a better understanding of what occurred during their appointment
  - ▶ 84% reported trusting their provider more
  - ▶ 81% endorsed feeling comforted or relieved after reading their health information

# Provider Experience

- " There are several things I am not comfortable \*managing\* via the portal, but I much prefer getting initially notified about them via the portal so that I can follow up via phone or in person as appropriate."
- "...I have had very rare instances where a patient sent something inappropriate or too long for secure messaging. I have found it helpful to have a conversation about the portal and stating that it is not for emergencies."

# Patient Experience

- “...When it comes to medical records **having immediate access to them has helped me in so many ways on so many occasions.** I look forward to the future and how they will expand. I currently use my chart and am in [town] **so every provider in my area that I go to utilizes it and again it’s just phenomenal.**”



# Patient Experience

“Being able to connect with my provider through the portal and skip a lot of the hurdles including waiting on hold sometimes for up to 45 minutes is really a different way of life and I appreciate it more and more every day. It also helps that my providers are fantastic people who are aware that sometimes just one simple question answered via a message can make a world of difference.”

# Patient Experience

“Some providers are exemplary: they answer within a few hours, they release test results as soon as they're available. Others do not respond at all or respond five or eight days later. And they're annoyed when you calmly request a more timely response. **In my experience, everything depends on the provider's willingness to use the portal as a valuable mode of communication.** I wish all of my providers could see it that way.”

# Pilot RCT- 6 Months N=30

## Intervention

Direct Training on How to Use Portal to Access Mental Health Notes and do Secure Messaging

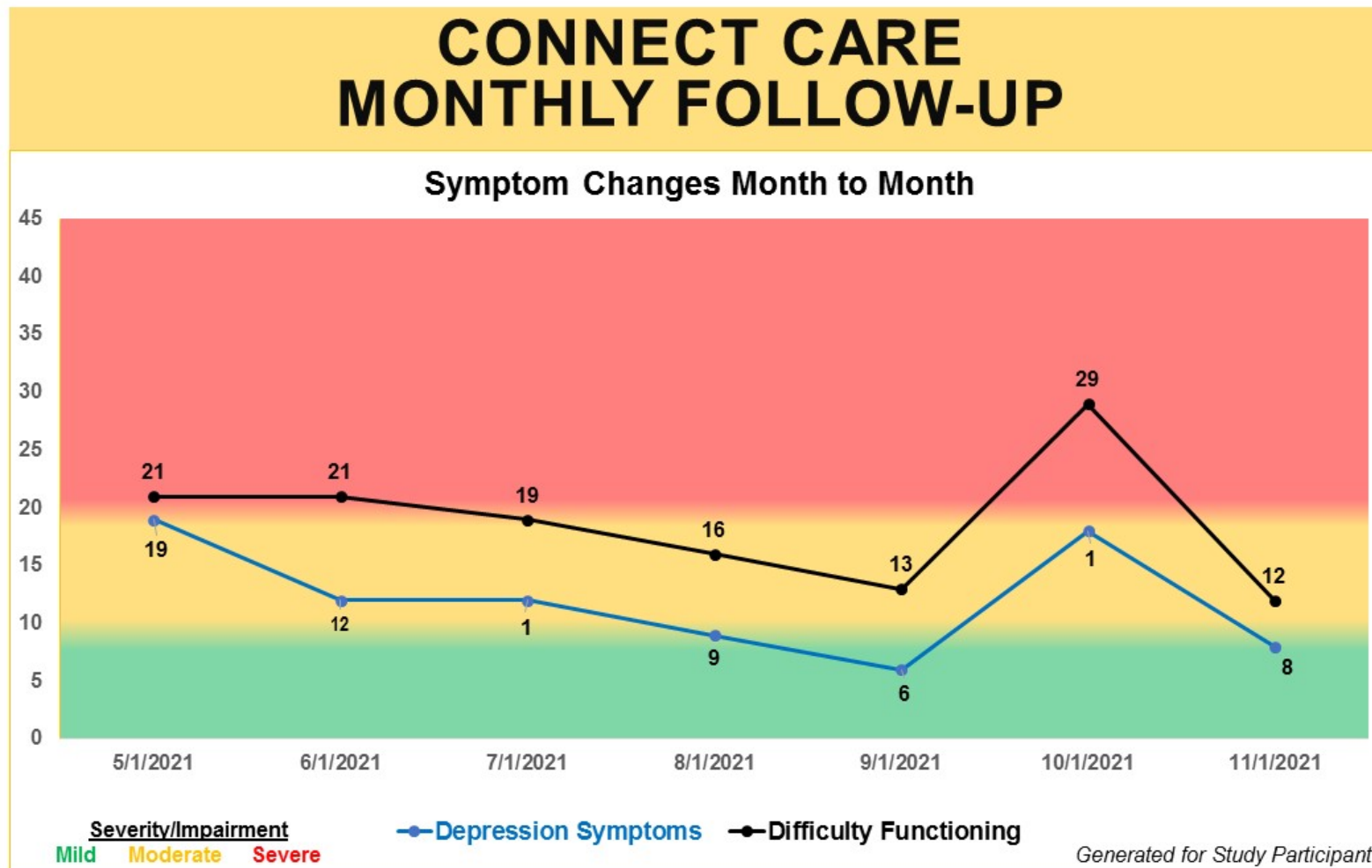
Monthly assessment and feedback on a measure of depression and a measure of functioning.

## Comparison Condition

Standard Training on How to Use a Patient Portal

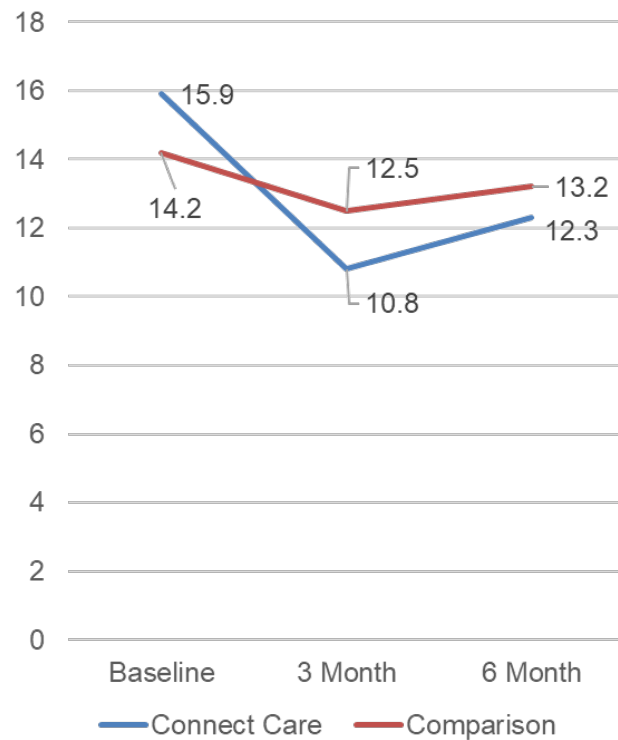
Assessment of Depression and Functioning at Baseline, 3- and 6-month follow-up

# Patient and Provider Feedback Sessions

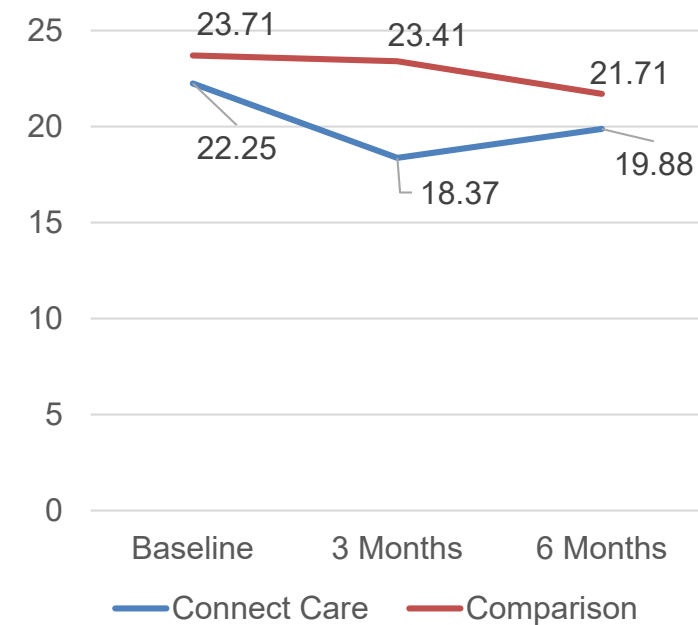


# Preliminary Results

## Depression Outcomes



## Work and Social Adjustment



# Patient Feedback

“Just by answering the questionnaires, I found areas I really need to work on.”

“At least I was aware of the trends and had this information to take back to therapy and other health professionals.”

“. . . The questionnaires helped me think about my depression. Instead of one looming and overwhelming cloud, breaking it into individual characteristics is helpful.”

MyChart  
by Epic

UNIVERSITY OF IOWA HEALTH CARE



Your Menu



Visits



Messages



Test Results



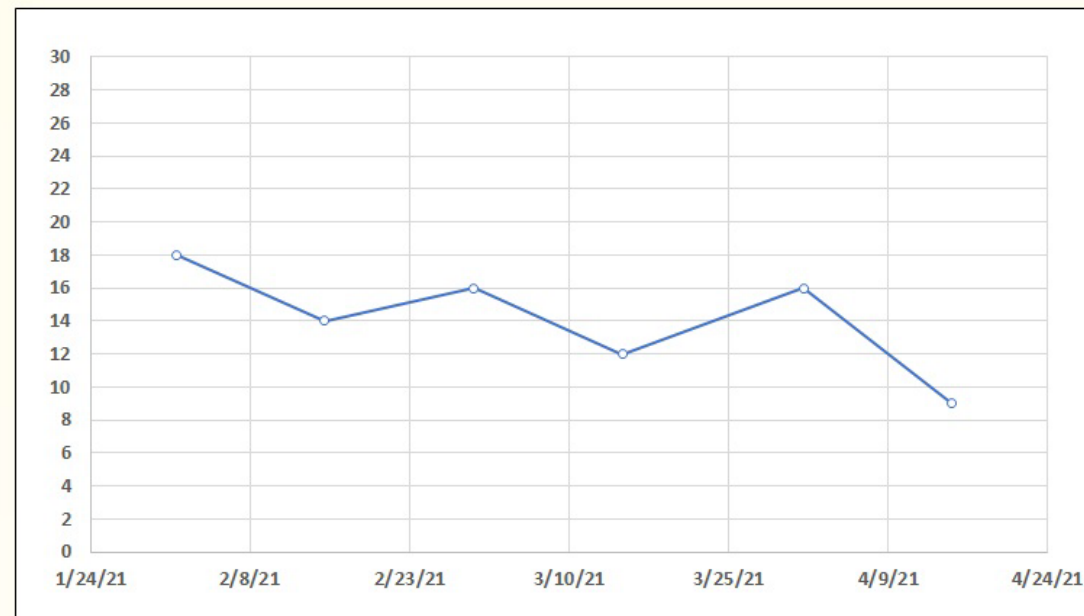
Medications

## Patient Health Questionnaire-9



Your report is displayed below. Use the Table and Graph buttons to see different views of the data.

Graph



Table

Graph

# Conclusions and Lessons Learned

Patients have positive experiences using patient portals in the context of their mental health treatment.

Providers were more positive about secure messaging than access to visit notes.

Engaging patients with their portals and providing ongoing visualization of assessments may slightly impact depression and functional outcomes.



# Contact Information

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AGENCY FOR HEALTHCARE RESEARCH AND QUALITY



# Reinforcement Learning to Increase Physical Activity in Diabetes and Depression

**Adrian Aguilera, PhD**

**UC Berkeley Social Welfare**

**UC San Francisco Psychiatry & Center for Vulnerable Populations**

# Diabetes and Depression

Comorbid Diabetes and Depression is Associated With

Worse  
prognosis of  
both diseases

Higher rate of  
complications  
of diabetes

Greater  
disability

Increased risk  
of mortality



Great need for treatments that target **overlapping risk factors** for diabetes and depression.



# Physical Activity



Diabetes

Depression

Improve with  
Increased  
physical  
activity

Sigal RJ, Armstrong MJ, Bacon SL, Boulé NG, Dasgupta K, Kenny GP, et al. Physical activity and diabetes. Canadian journal of diabetes. 2018;42:S54-S63.  
Cooney G, Dwan K, Greig C, Lawlor D, Rimer J, Waugh F, et al. Exercise for depression Cochrane Database. Syst Rev. 2013;9:CD004366.

# Mobile Health Apps for Activity



Mobile apps have been found effective in helping patients engage in healthy behaviors including physical activity



Meta-analysis of nine RCT's concluded that smartphone apps that focus on physical activity have a moderate positive effect on increasing physical activity levels

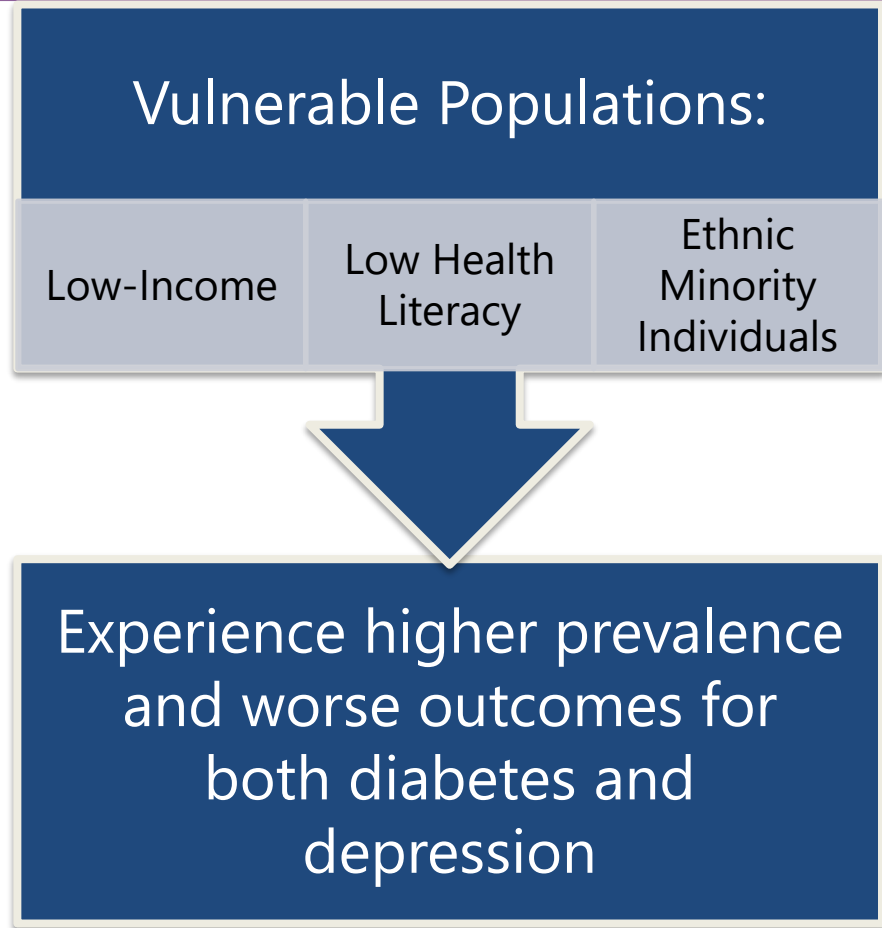


Meta-analysis including 18 studies moderate to large effect in daily step changes

Romeo A, Edney S, Plotnikoff R, Curtis R, Ryan J, Sanders I, et al. Can Smartphone Apps Increase Physical Activity? Systematic Review and Meta-Analysis. J Med Internet Res. 2019;21(3):e12053.

Gal R, May AM, van Overmeeren EJ, Simons M, Monninkhof EM. The effect of physical activity interventions comprising wearables and smartphone applications on physical activity: a systematic review and meta-analysis. Sports medicine-open. 2018;4(1):42.

# Health Disparities



Digital health interventions not typically designed with and for these populations who have highest need

Thomas J, Jones G, Scarinci I, Brantley P. A descriptive and comparative study of the prevalence of depressive and anxiety disorders in low-income adults with type 2 diabetes and other chronic illnesses. *Diabetes care*. 2003;26(8):2311-7.

Colon E, Giachello A, McIver L, Pacheco G, Vela L. Diabetes and depression in the Hispanic/Latino community. *Clinical Diabetes*. 2013;31(1):43-5.



# Who Are We Designing For?

**CHICKS DIG  
WINNERS**



**APPLE WATCH SPORT**



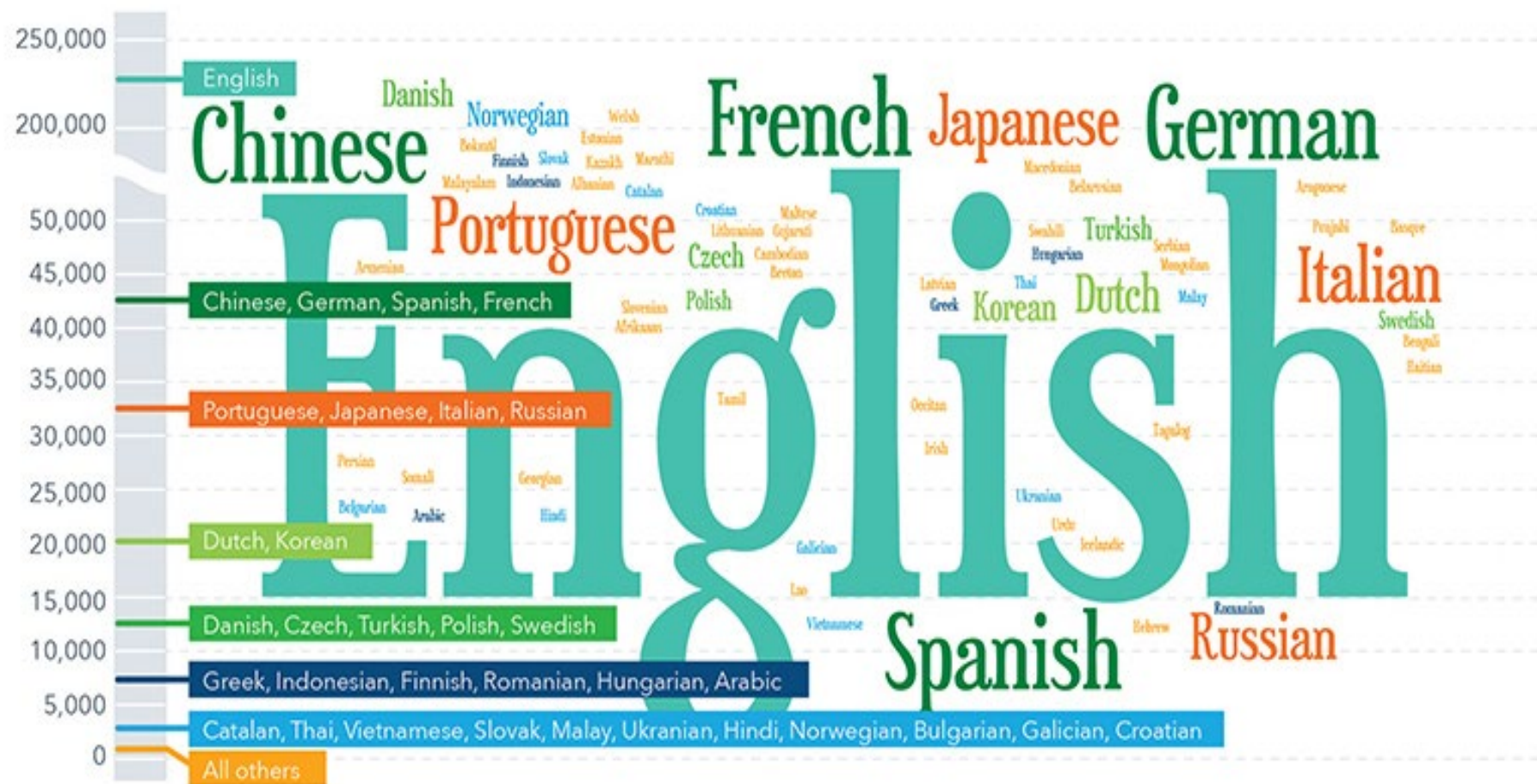
**Designed with travel in mind.**



From running through the airport, to running after work, checking flight delays and checking out at the register, the Apple Watch goes beyond expectations to make your life easier. Find out about gate and schedule changes. Get notified when it's time to leave for the airport. Check in for your flight. And view a map while en route. Now starting at \$649.

**APPLE WATCH**  
apple.com/watch

# Digital Health Apps by Language



Sources: 42 Matters, Jul 2017; IQVIA AppScript Database, Jul 2017; IQVIA Institute, Sep 2017  
 Report: The Growing Value of Digital Health. IQVIA Institute for Human Data Science, Nov 2017



# Personalization



Polgreen LA, Anthony C, Carr L, Simmering JE, Evans NJ, Foster ED, et al. The effect of automated text messaging and goal setting on pedometer adherence and physical activity in patients with diabetes: A randomized controlled trial. PLoS one. 2018;13(5):e0195797.

Nahum-Shani I, Smith SN, Spring BJ, Collins LM, Witkiewitz K, Tewari A, et al. Just-in-Time Adaptive Interventions (JITIs) in Mobile Health: Key Components and Design Principles for Ongoing Health Behavior Support. Annals of behavioral medicine : a publication of the Society of Behavioral Medicine. 2018;52(6):446-62.

# Goal



**Leverage Text Messaging to Provide  
Personalized Motivation for Physical  
Activity**

## **Diabetes & Mental Health Adaptive Notifications Texting Study**

- Interventions for Depression and Diabetes are siloed
- Physical activity is a core mechanism
- Mobile health interventions need to be:
  - ▶ Personalized
  - ▶ Integrated into care
  - ▶ Developed with vulnerable populations

# Outcomes

## **Proximal outcomes:**

- Physical activity (steps)
- Daily mood and anhedonia (PHQ-2)

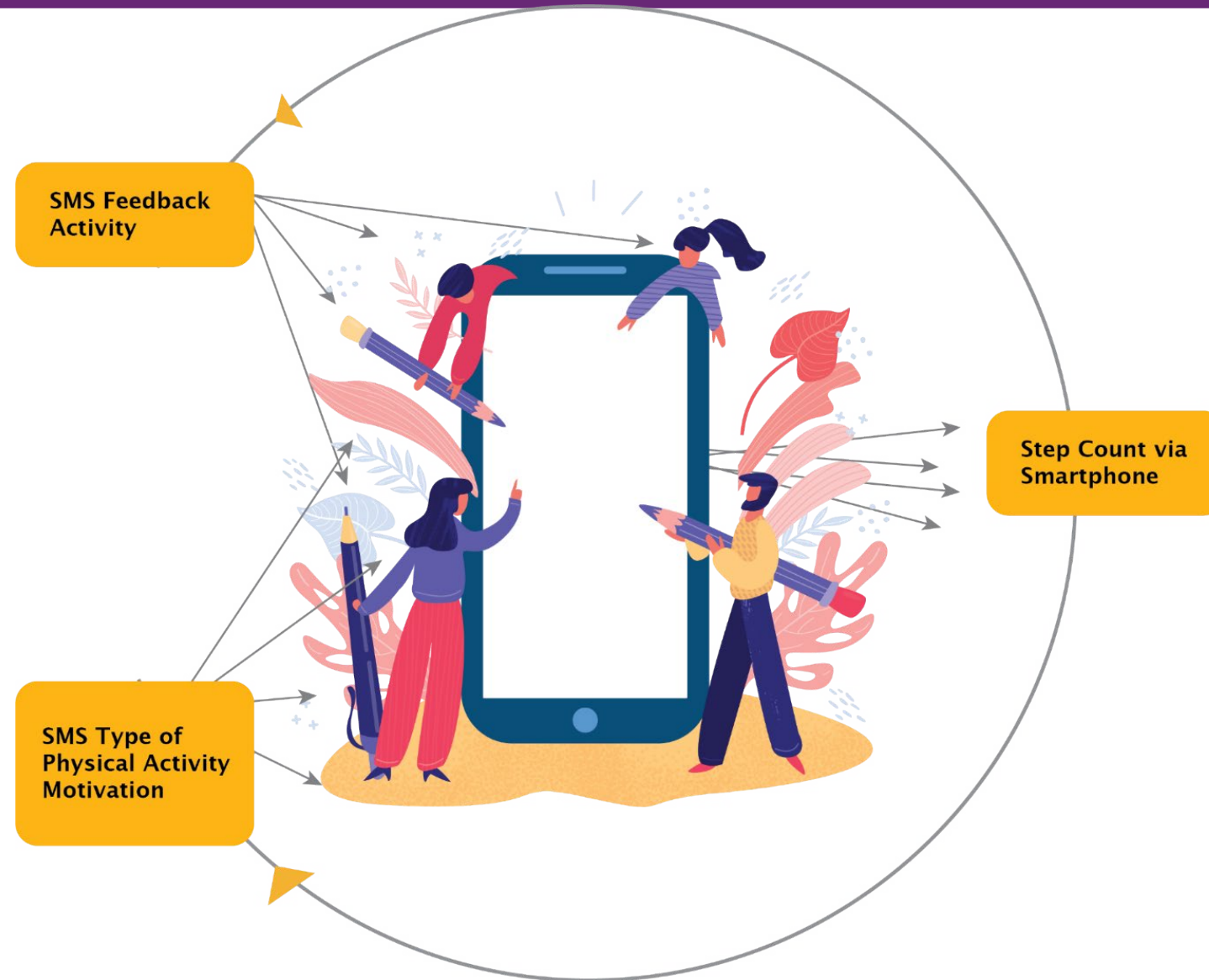
## **Distal outcomes:**

- Physical activity over time
- Daily mood and anhedonia over time
- HbA1c over time

## **Pre and post:**

- PHQ-9
- Behavioral activation scores
- Self efficacy scores

# Messaging Algorithm Flow



# DIAMANTE App



Friday: February 22, 2019	3008 Steps
Thursday: February 21, 2019	4292 Steps
Wednesday: February 20, 2019	6808 Steps
Tuesday: February 19, 2019	6714 Steps
Monday: February 18, 2019	11293 Steps
Sunday: February 17, 2019	10149 Steps
Saturday: February 16, 2019	6719 Steps
Friday: February 15, 2019	14905 Steps
Thursday: February 14, 2019	20513 Steps
Wednesday: February 13, 2019	10015 Steps
Tuesday: February 12, 2019	12306 Steps

11:29 LTE

< DIAMANTE

audio FaceTime info

You did not achieve your step goal yesterday.

By doing more physical activity, you will be setting a good example for those around you.

Wednesday 12:02 PM

Yesterday, you walked less than your goal.

Too many things going on at home? Make time for yourself and use physical activity as a way to de-stress and take care of your health.

Yesterday 3:31 PM

Yesterday, you walked less than your goal.

The benefits of physical activity are not just for you, they are also for your family.

Camera App Store Text Message

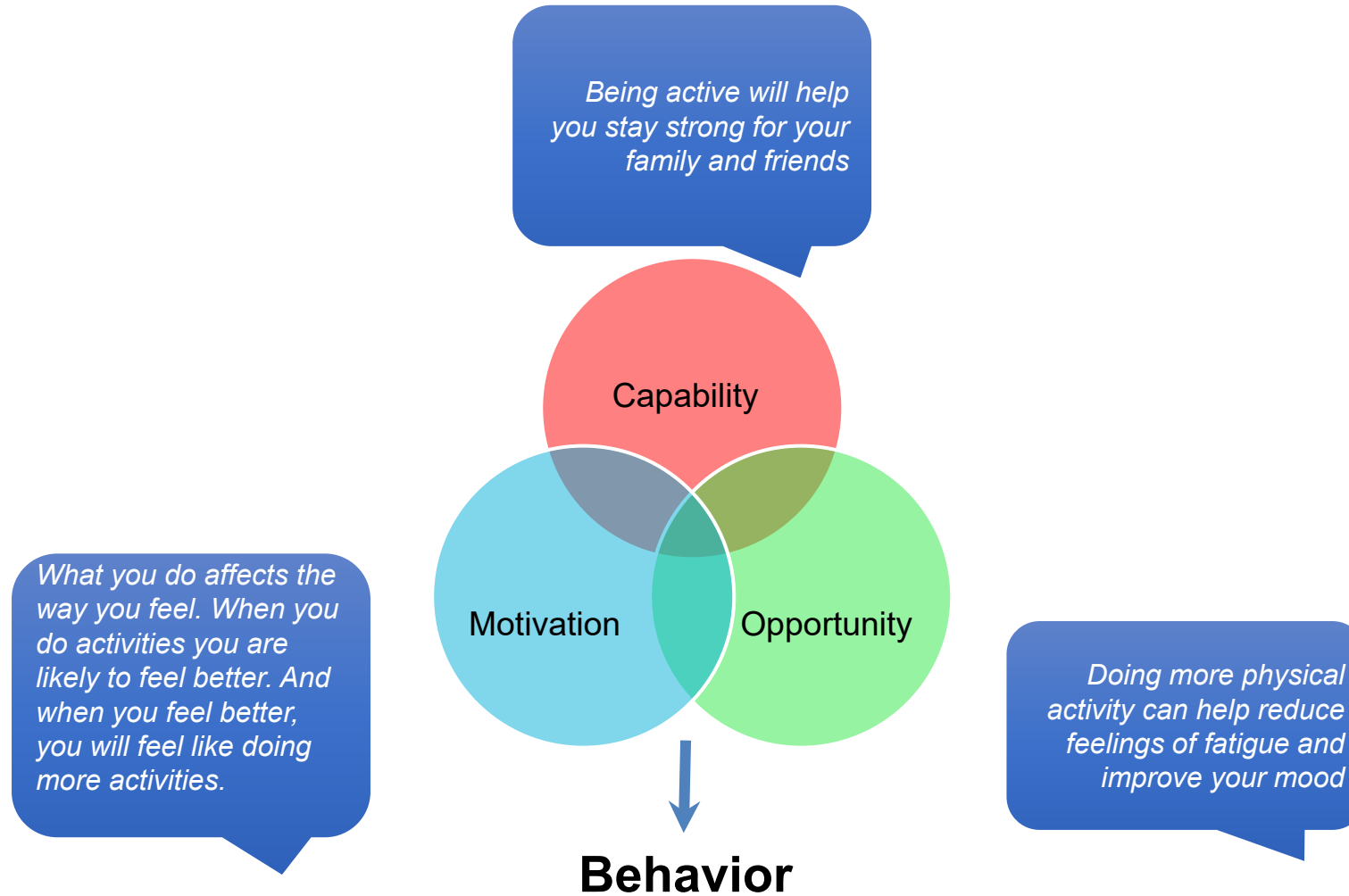
App Store App Store Apple Pay Home Screen

# Reinforcement Learning Intervention

## **Increase physical activity via:**

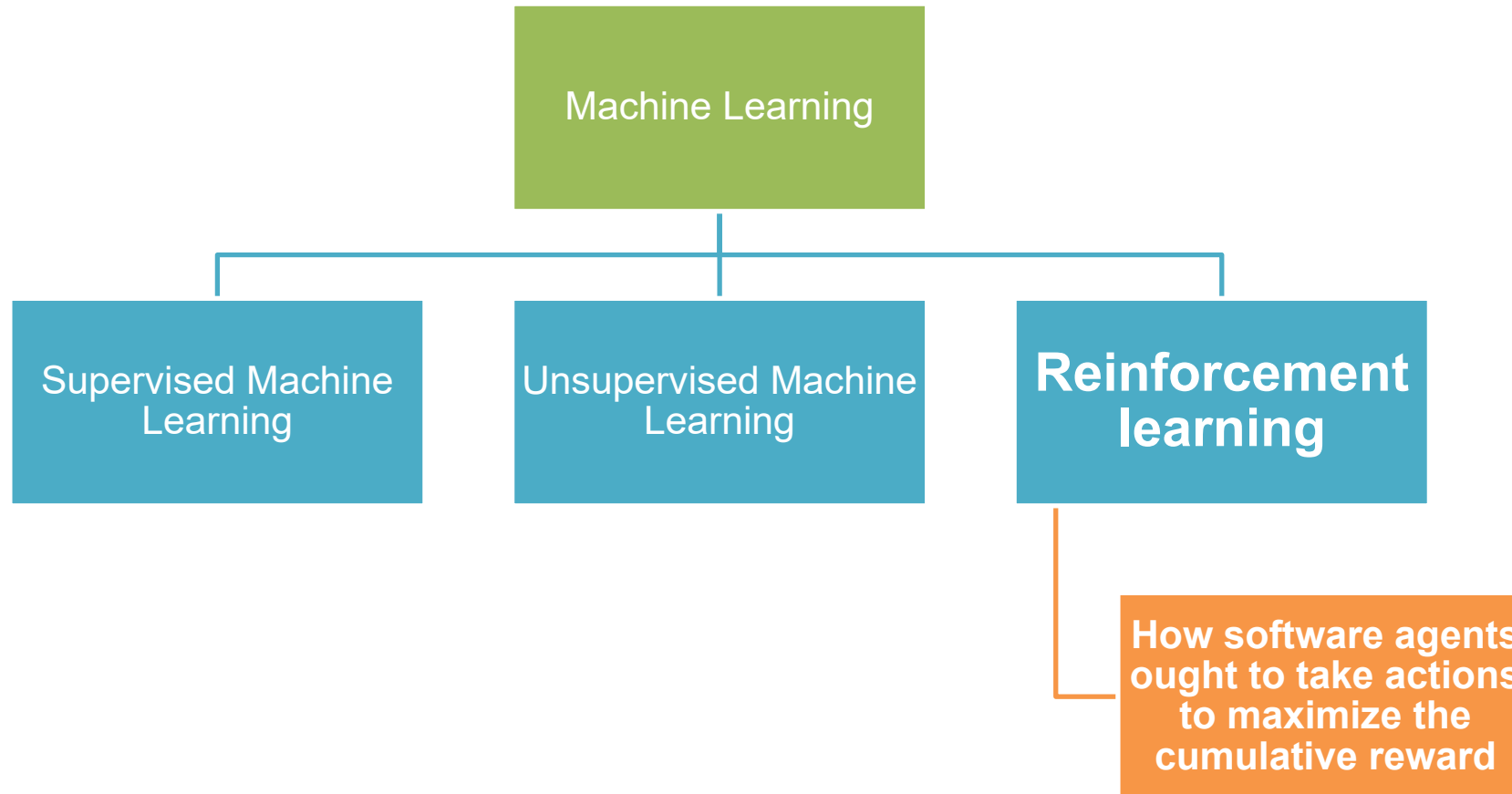
- ▶ Smartphone Passive Sensing of steps
- ▶ Personalized messaging using a reinforcement learning algorithm
- ▶ Target individuals' specific motivators

# COM-B





# Reinforcement Learning



# Important Terms



Action variable: Actions to be taken by algorithm



Contextual variables: A participant's state (characteristics, behavior, surroundings)



Reward: Outcome



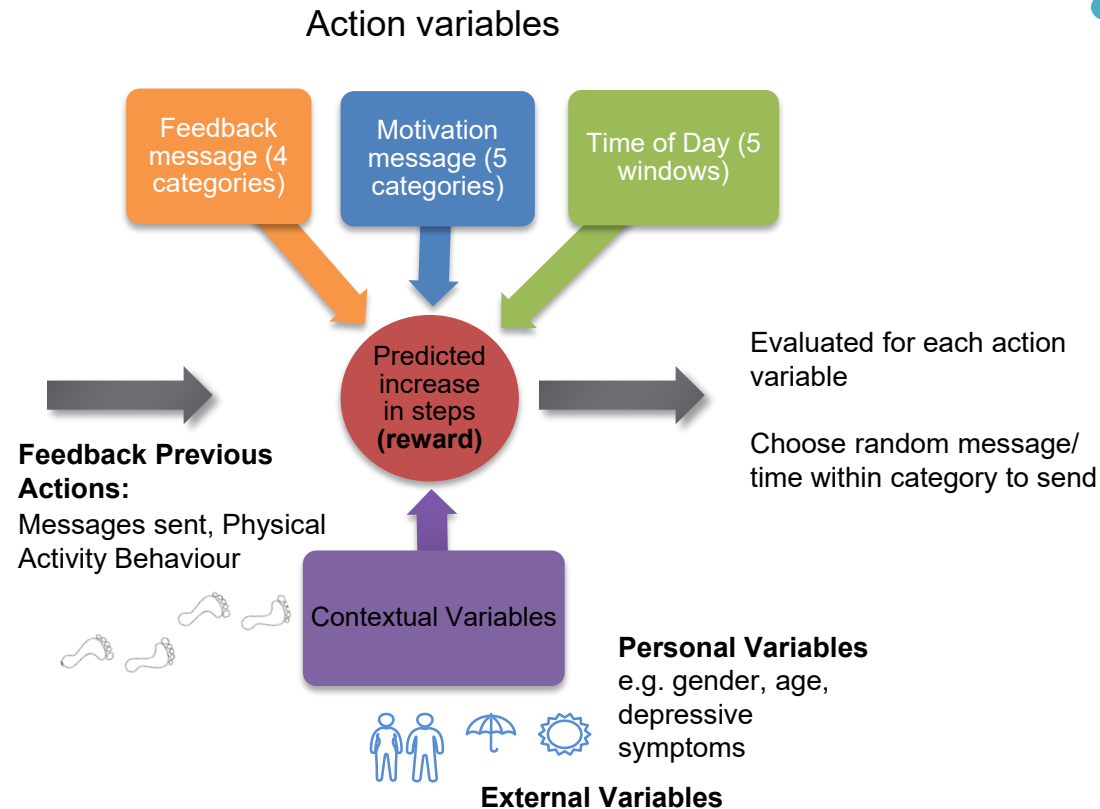
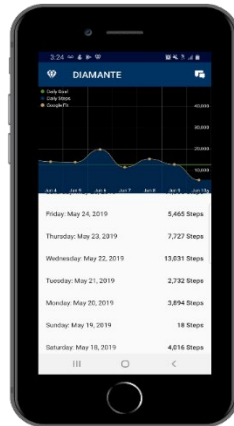
Model: How we predict what the potential reward might be, as a function of the action and contextual variables

# The Reinforcement Learning Process

2 Optimize messaging via Bayesian regression model that runs daily.

3 Send Messages & Track Activity

1 Setup Goal

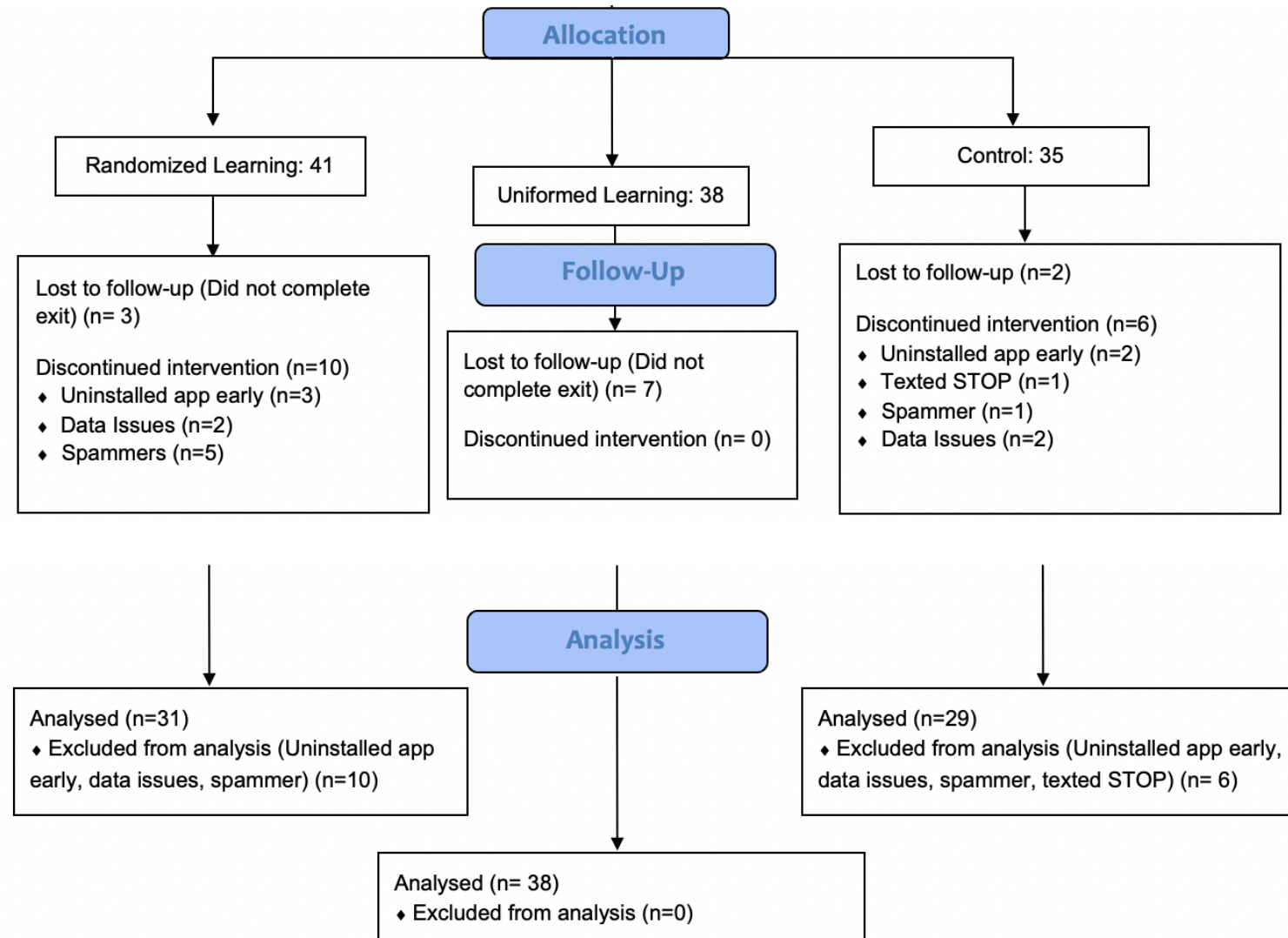


Actions predicted not to be the best ones will still be tested (Thompson Sampling)

# Methods

- Participants & Setting
  - ▶ Low-income patients from San Francisco General Hospital (SFGH)
  - ▶ English or Spanish speakers
  - ▶ Diabetes diagnosis and depression symptoms
  
- Patients assigned to receive either:
  1. Reinforcement Learning messages
  2. Random messages
  3. Only App and reminder to track steps

# DIAMANTE Trial Design



# COVID-19 Pandemic Started One Month After Launch



## Challenges

- COVID-19 created a need to transition to remote recruitment
- Inability to meet patients in person to help download DIAMANTE app and complete baseline survey/onboarding
- UCSF-approved remote study procedures presented additional challenges for SFHN patients wanting to enroll in DIAMANTE trial:
  - ▶ Unfamiliar and unable to access to DocuSign/email for remote consent & HIPAA waiver
  - ▶ Qualtrics platform was able to text participant the study surveys, but many needed assistance completing each item
  - ▶ Substantial difficulty with DIAMANTE app downloading without in-person trial onboarding visit

# Adaptations To Remote Recruitment For Patients

- Developed educational materials
  - ▶ YouTube videos on how to access Zoom for remote study visit, download DIAMANTE app
  - ▶ Steps on how to access email and DocuSign
- At visit, sent real-time SMS links for downloading Zoom and study app
- If unable to video, staff provided verbal troubleshooting to common technical issues in both English and Spanish for Android & iOS
- Staff welcomed tech-hesitant patients to invite loved ones to help at onboarding session

# Sample (As of 3/22)

Table 1. Baseline demographic characteristics.	All (n=177)	ZSFG (n=65)	Online (n=112)
Age (years), mean (SD)	47.9 (12.3)	53.6 (10.2)	44.6 (12.3)
Interview language, n (%)			
Spanish	48 (27.1%)	39 (60%)	9 (8%)
English	129 (72.9%)	26 (40%)	103 (92%)
Sex, n (%)			
Female	104 (58.8%)	33 (50.8%)	71 (63.4%)
Male	68 (38.4%)	30 (46.2%)	38 (33.9%)
Transgender	4 (2.3%)	2 (3.1%)	2 (1.8%)
Race/Ethnicity, n (%)			
White	51 (28.8%)	5 (7.7%)	46 (41.1%)
Black	30 (16.9%)	8 (12.3%)	22 (19.6%)
Hispanic	67 (37.9%)	42 (64.6%)	25 (22.3%)
AAPI	10 (5.6%)	4 (6.2%)	6 (5.4%)
Multi-Ethnic	18 (10.2%)	5 (7.7%)	13 (11.6%)
High school education or less, n (%)	36 (20.3%)	30 (46.2%)	6 (5.4%)
Employment status, n (%)			
Disabled or on disability	27 (15.3%)	19 (29.2%)	8 (7.1%)
Part-time or more	94 (53.1%)	27 (41.5%)	67 (59.9%)
Unemployed	33 (18.7%)	10 (15.4%)	23 (20.5%)
Retired	10 (5.6%)	5 (7.7%)	5 (4.5%)
Homemaker	11 (6.2%)	4 (6.2%)	7 (6.3%)



# Digital Literacy

<b>Table 2. Patients' digital profiles</b>	<b>All (n=177)</b>	<b>ZSFG (n=65)</b>	<b>Online (n=112)</b>
Digital access, n (%)			
WIFI at home	138 (78%)	43 (66.2%)	95 (84.8%)
Smartphone type, n (%)			
iPhone	75 (42.4%)	24 (36.9%)	51 (45.5%)
Android	99 (55.9%)	41 (63.1%)	58 (51.8%)
Digital literacy, n (%)			
Difficulty using smartphone	33 (18.7%)	25 (38.4%)	8 (7.1%)
Difficulty installing apps	47 (26.5%)	37 (56.9%)	10 (8.9%)

# DIAMANTE Design Process: Decisions from Phase 1

Intervention needs identified	Design decisions made to the DIAMANTE intervention
<p><b>Content of text messages</b></p> <p><b>Messaging characteristics</b></p>	<p>3 motivation categories for text messages:</p> <ol style="list-style-type: none"> <li>1. Messages to increase self-efficacy</li> <li>2. Messages emphasizing benefits of walking</li> <li>3. Messages that elicit opportunity cues</li> </ol> <p>Messages that remind participants to carry phone while walking</p> <p>One-way messaging</p> <p>Lower reading level</p>
<p><b>Physical activity education</b></p> <p><b>Goal setting</b></p> <p><b>Assessment of social isolation</b></p> <p><b>Assessment of physical mobility</b></p>	<p>All participants received baseline physical activity education</p> <p>Baseline daily step goal relative to average steps in the past week or minimum of 4,000, whichever is higher</p> <p>Feedback messages will include relative to goal terms instead percentages (to minimize numeracy burden)</p> <p>Level of social isolation may reduce emphasis on family-focused messaging</p> <p>Level of mobility will be broad given high rates of chronic pain and disability in the population</p>

# Participant Feedback

## From exit interviews:

- Patients feel accomplished and proud of themselves
- Seeing their steps on the app or knowing they were able to walk for 30 minutes or more made them feel like they reached a goal
- They were about to make progress in whichever way they define progress, for some it was losing some weight, others just felt better after walking, and for others it was creating a routine to walk that included their family
- The messages allowed them to feel connected to their health journey
- They felt like someone was checking on them (especially during CO-VID) and they used those moments to reflect on their mental health

87% strongly agree that the program was easy to use

91% agree or strongly agree that they would like to use the program frequently

67% choose to extend messaging for an additional 10 weeks

# Takeaways

- Academic-oriented digital health research can blend co-design approaches with more traditional evaluation
- Need careful attention to equity within methodological and measurement approaches
- More to come on rollout and effectiveness of DIAMANTE intervention during COVID-19 pandemic!

# Summary

Digital health co-design can greatly improve the engagement with and relevance of a platform

Reinforcement learning is a novel approach to text messaging interventions that might be better tailored to individuals

The pandemic presented multiple challenges to conducting randomized trials in safety net healthcare settings

Online recruitment methods are promising but tap into a different audience for studies

# Moving Forward

Digital recruitment requires in-person support --> we cannot assume digital health will entirely replace humans in our work

COVID clearly impacted both physical activity and depressive symptoms (and probably diabetes control), and we will have interesting data during the pandemic for secondary analyses

# Thank you!

The Amazing DIAMANTE Team: Adrian Aguilera, Faviola Garcia, Rosa Hernandez-Ramos, José Miramontes, Anupama Cemballi, Caroline Figueroa, Karina Rosales, Marvyn Arévalo, Chris Karr, and many others!

# Contact Information

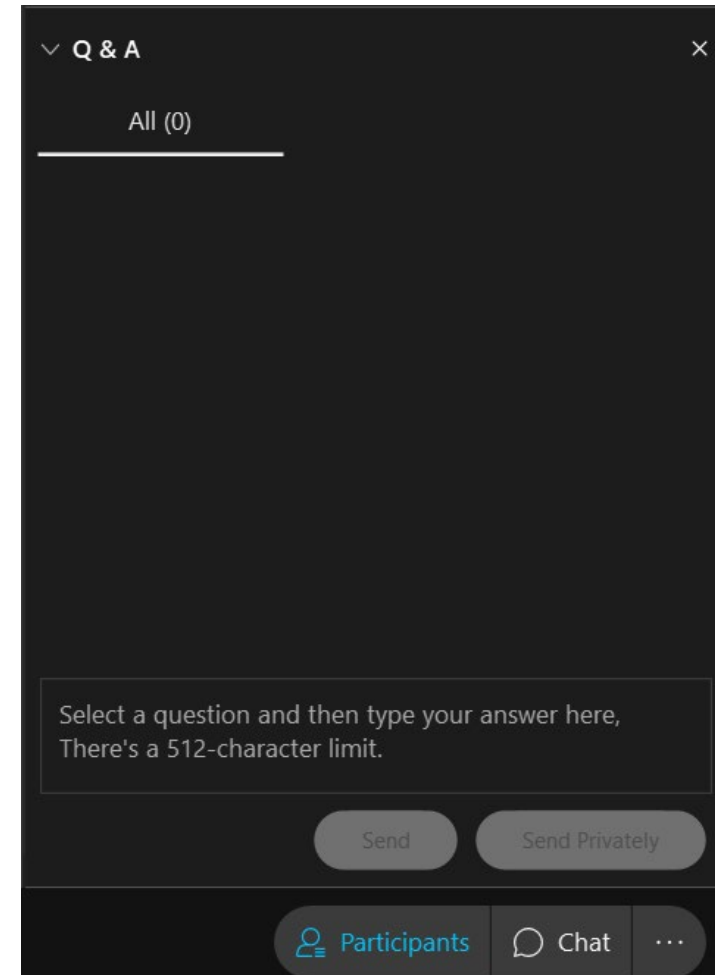
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A screenshot of the WebEx Q&A panel interface. At the top, it says "Q & A" with a dropdown arrow and a close button. Below that, it says "All (0)". The main area is a large text input field with a placeholder that reads "Select a question and then type your answer here, There's a 512-character limit." At the bottom of the input field are two buttons: "Send" and "Send Privately". At the very bottom of the panel are three tabs: "Participants" (with a person icon), "Chat" (with a speech bubble icon), and a menu icon (three dots).

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